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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Ex parte ALEXANDRE VIMONT, PATRICIA HORCAJADA CORTES, YOUNG KYU HWANG, GERARD FEREY, MARCO DATURI, JONG-SAN CHANG, CHRISTIAN SERRE, and JI YOON[1]

Appeal 2016-004194
Application 13/322,321
Technology Center 1700

Before TAWEN CHANG, RYAN H. FLAX, and RACHEL H. TOWNSEND, *Administrative Patent Judges*.

FLAX, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal under 35 U.S.C. § 134(a) involving claims directed to a method for removing nitrogen oxides from a medium using a metal organic framework (MOF). Claims 2–4, 11, 13–16, 18, 21, and 27–29 are on appeal as rejected under 35 U.S.C. § 103(a). We have jurisdiction under 35 U.S.C. § 6(b).

We affirm.

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[1] We understand the Real Parties in Interest to be Centre National de la Recherche Scientifique (CNRS), University de Caen Basse - Normandie, Ensi Caen, Universite de Versailles - Saint-Quentin-Enyvelines, and KRICT (Korea Research Institute of Chemical Technology). Br. 1.

STATEMENT OF THE CASE

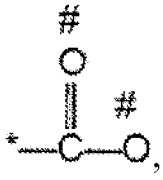
The Specification states, "[t]he MOF solids of the present invention are advantageously able to remove nitrogen oxides from a liquid or gaseous effluent, for example water, the exhaust gases from a vehicle, factory, workshop, laboratory, stored products, urban air vents, etc." Spec. 1:22–26.

The appealed claims can be found in the Claims Appendix of the Appeal Brief. Claim 18 is the sole independent claim, is representative, and reads as follows:

> 18. A method for removing nitrogen oxides from a medium comprising:
>
> contacting the medium with a catalyst comprising a porous crystalline Metal-Organic Framework (MOF) solid, where the contacting step is carried out in the presence of oxygen and water, the MOF solid consisting of a three-dimensional succession of units corresponding to the following formula (I):
>
> $$M_mO_kX_lL_p \qquad (I)$$
>
> where, in formula (I):
>
> - each occurrence of M represents independently a metal cation M selected from the group consisting of Al^{3+}, Ca^{2+}, Cu^{+}, Cu^{2+}, Cr^{3+}, Fe^{2+}, Fe^{3+}, Ga^{3+}, Mg^{2+}, Mn^{2+}, Mn^{3+}, Mn^{4+}, Ti^{3+}, Ti^{4+}, V^{3+}, V^{4+}, Zn^{2+}, Zn^{3+}, Zr^{4+}, and Ln^{3+} in which Ln is a rare earth;
> - m is 1 to 12;
> - k is 0 to 4;
> - l is 0 to 18;
> - p is 1 to 6;
> - X is an anion selected from the group consisting of OH^{-}, Cl^{-}, F^{-}, I^{-}, Br^{-}, SO_4^{2-}, NO_3^{-}, ClO4^{-} [sic], PF_6^{-}, BF_4^{-},

$R\text{-}(COO)_n^-$ where R is as defined below, $R^1\text{-}(COO)_n^-$, $R^1\text{-}(SO_3)_n^-$, $R^1\text{-}(PO_3)_n^-$, where R^1 is a hydrogen, a linear or branched, optionally substituted C_1-C_{12} alkyl, and an aryl, where n is an integer from 1 to 4;

• L is a spacer ligand comprising a radical R having q

carboxylate groups  , where

- q is 1, 2, 3, 4, 5 or 6;

- * denotes the point of attachment of the carboxylate to the radical R;

- # denotes the possible points of attachment of the carboxylate to the metal ion;

- R represents:

(i) a C_{1-12}alkyl, C_{2-12}alkenyl or C_{2-12}alkynyl radical;

(ii) a fused or unfused, mono- or polycyclic aryl radical comprising 6 to 50 carbon atoms;

(iii) a fused or unfused, mono- or polycyclic heteroaryl comprising 1 to 50 carbon atoms;

(iv) an organic radical comprising a metallic element selected from the group consisting of ferrocene, porphyrin, and phthalocyanine;

the radical R optionally being substituted with one or more groups R^2, selected independently from the group consisting of C_{1-10}alkyl; C_{2-10}alkenyl; C_{2-10}alkynyl; C_{3-10}cycloalkyl; C_{1-10}heteroalkyl; C_{1-10}haloalkyl; C_{5-10}aryl; C_{3-20}heterocyclic; C_{1-10}alkylC_{6-10}aryl; C_{1-10}alkylC_{3-10}heteroaryl; F; Cl; Br; I; $-NO_2$; -CN; $-CF_3$; $-CH_2CF_3$; -OH; $-CH_2OH$; $-CH_2CH_2OH$; $-NH_2$; $-CH_2NH_2$; -NHCHO; -COOH; -CONH; $-SO_3H$; $-CH_2SO_2CH_3$;

and -PO_3H_2; or a function –Gr^{G1} in which R^{G1} is an alkyl group and in which G is -O-, -S-, -NR^{G2}-, -C(=O)-, -S(=O)-, -SO_2, -C(=O)O-, -C(=O)NR^{G2}-, -OC(=O)-, -NR^{G2}C(=O)-, -OC(=O)O-, -OC(=O)NRG2-, -NR^{G2}C(=O)O-, -NR^{G2}C(=O)NR^{G2}-, -C(=S)-, where each occurrence of R^{G2} is, independently of the other occurrences of R^{G2}, a hydrogen atom; or a C_{1-12}alkyl, C_{1-12}heteroalkyl, C_{2-10}alkenyl or C_{2-10}alkynyl function, linear, branched or cyclic, optionally substituted; or a C_{6-10}aryl, C_{3-10}heteroaryl, C_{s-10}heterocyclic, C_{1-10}alkylC_{6-10}aryl or C_{1-10}alkylC_{3-10}heteroaryl group in which the aryl, heteroaryl or heterocyclic radical is optionally substituted; or else, when G represents -NR^{G2}-, R^{G1} and R^{G2}, together with the nitrogen atom to which they are bound, form a heterocycle or a heteroaryl, optionally substituted; and

removing nitrogen oxides from the medium by thereby effecting catalytic decomposition of the nitrogen oxides with the catalyst.

Br. 14–17 (Claims App'x).

The following rejection is on appeal:

Claims 2–4, 11, 13–16, 18, 21, and 27–29 stand rejected under 35 U.S.C. § 103(a) over Morris,[2] Bashkova,[3] and Chang.[4] Final Act. 2.

DISCUSSION

We adopt the Examiner's findings of fact, reasoning on scope and content of the prior art, and conclusions set out in the Final Action and

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[2] International Patent Application Pub. No. WO 2008/020218 A1, published February 21, 2008 ("Morris").

[3] Svetlana Bashkova and Teresa J. Bandosz, *Adsorption/Reduction of NO_2 on Graphite Oxide/Iron Composites*, 48 IND. ENG. CHEM. RES. 10884–91 (2009) ("Bashkova").

[4] International Patent Application Pub. No. WO 2008/072896 A1 (published June 19, 2008) ("Chang").

Answer. We find the Examiner has established that the claims would have been obvious over Morris, Bashkova, and Chang. Appellants have not produced evidence showing, or persuasively argued, that the Examiner's determinations of obviousness are incorrect. Only those arguments made by Appellants in the Brief have been considered in this Decision. Arguments not presented in the Brief are waived. *See* 37 C.F.R. § 41.37(c)(1)(iv) (2015). We have identified claim 18 as representative; therefore, all claims fall with claim 18.

Appellants summarized their arguments as follows:

> The Office Action's mere conclusory statement, unsupported by evidence, that "it would be obvious to remove a car['s] exhaust[] under the atmosphere in the presence of oxygen and moisture," fails to provide a *prima facie* case of obviousness with respect to this element.
>
> Chang fails to supply at least this deficiency of Morris. Therefore, even if Chang could be combined with Morris (not admitted), the combination would not achieve the invention as recited in amended claim 18.

Br. 11. Appellants also contend Morris's examples are directed to an "absorbent" using "hybrid material(s) containing iron having a large surface area and a high pore volume, in particular, a water absorbent," rather than an "adsorbent containing MIL-100(Fe) taught by Chang." Br. 10. We do not find these arguments persuasive.

The Examiner established that the prior art combination, in particular Morris abstract, 4–8, and Chang ¶¶ 109, 116–120, 174, disclosed an MOF structure within the scope of the claims (Fe^{3+}-1,3,5-benzene tricarboxylic acid-hydroxy anion; MIL-100(Fe); and $Fe_3O(H_2O)_2(OH)[C_6H_3(CO_2)_3]_2 \bullet nH_2O$), used for the same purpose recited by the claims, i.e., removing nitric

oxides from car exhausts and waste gas streams (the medium of the instant claim) via contacting nitric oxides with a porous crystalline metal organic frameworks, as disclosed by Morris). *See* Final Action 3–6 (discussing Morris, Bashkova, and Chang). The Examiner also determined "it would be obvious to remove [NO_x from] a car['s] exhaust[] under the atmosphere. And it is known that the atmosphere contains about 20% oxygen and less than 10%wt of water as the instant claims 28-29. It is also known [that] car exhausts contains nitrogen oxides (NOx) and oxygen . . . ." Ans. 4.

Implicit in the Examiner's determination regarding removal of NO_x from car exhaust (which is well known, and disclosed by Bashkova 10884, to contain NO_x) in the Earth's atmosphere (Ans. 4) is that it is well-known that the Earth's atmosphere includes oxygen and water vapor under normal conditions.[5] Regardless of where the NO_x removal of Morris occurs, whether inside a car's exhaust system or outside in the natural environment, oxygen and water vapor will be present during the NO_x removal.

> Where . . . [as here,] the claimed and prior art products are identical or substantially identical . . . the PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his claimed

[5] *See*, *e.g.*, Nasa, *Earth Fact Sheet*, available at https://nssdc.gsfc.nasa.gov/planetary/factsheet/earthfact.html (visited April 13, 2017). It is also implicit in the Examiner's determination that car exhaust normally includes oxygen and water vapor. *See* Volkswagen-Audi, *Self-Study Programme 230 Motor Vehicle Exhaust Emissions* 7 (undated) (available at http://www.volkspage.net/technik/ssp/ssp/SSP_230.pdf (visited Apr. 13, 2017); and Elliott et al., *The Composition of Exhaust Gases from Diesel, Gasoline and Propane Powered Motor Coaches*, 5 J. AIR POLLUTION CONTROL ASSOCIATION 103–08, 103 (1955) (each identifying that car exhaust also normally contains oxygen and water vapor).

> product. . . . [The] fairness [of the burden-shifting] is evidenced by the PTO's inability to manufacture products or to obtain and compare prior art products.

In re Best, 562 F.2d 1252, 1255 (CCPA 1977). Here, Appellants have not established that the claimed invention is different (or not obvious in view of) the MOFs of Morris and Chang, used to remove nitrogen oxides from car exhaust as disclosed by Morris.

SUMMARY

The rejection under 35 U.S.C. § 103(a) is affirmed.

TIME PERIOD FOR RESPONSE

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a).

AFFIRMED